



Clinical pain research

Association of Modic changes with health-related quality of life among patients referred to spine surgery



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HIGHLIGHTS

- Modic changes (MC) are vertebral endplate lesions in magnetic resonance imaging.
- 46% of 181 patients referred to spine surgery had MC (37% Type I and 63% Type II).
- MC were associated with duration of low back pain and degree of disc degeneration.
- Type II MC were associated with worse mental status of quality of life.

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ABSTRACT

Background and purpose: Modic changes (MC) are bone marrow and vertebral endplate lesions seen in magnetic resonance imaging (MRI) which have been found to be associated with low back pain (LBP), but the association between MC and health-related quality of life (HRQoL) is poorly understood. The aim of this study was to assess the relationship between MC and HRQoL among patients referred to spine surgery.

Methods: The study population consisted of 181 patients referred to lumbar spine surgery in Northern and Eastern Finland between June 2007 and January 2011. HRQoL was assessed using RAND-36 health survey. Lumbar MC were evaluated and classified into 'No MC', 'Type I' (Type I or I/II), and 'Type II' (Type II, II/III or III).

Results: In total, 84 patients (46%) had MC. Of these, 37% had 'Type I' and 63% 'Type II'. Patients with MC were older, more likely females, had longer duration of LBP and a higher degree of disc degeneration than patients without MC. The total physical component or physical dimensions did not differ significantly between the groups. The total mental component of RAND-36 ($P=0.010$), and dimensions of energy ($P=0.023$), emotional well-being ($P=0.012$) and emotional role functioning ($P=0.016$) differed significantly between the groups after adjustments for age and gender. In the mental dimension scores, a statistically significant difference was found between 'No MC' and 'Type II'.

Conclusions: Among patients referred to spine surgery, MC were not associated with physical dimensions of HRQoL including dimension of pain. However, 'Type II' MC were associated with lower mental status of HRQoL.

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Implications: Our study would suggest that Type II MC were associated with a worse mental status. This may affect the outcome of surgery as it is well recognized that patients with depression, for instance, have smaller improvements in HRQoL and disability. Thus the value of operative treatment for these patients should be recognized and taken into consideration in treatment. Our study shows that MC may affect outcome and thus clinicians and researchers should be cognizant of this and take this into account when comparing outcomes of surgical treatment in the future. A longitudinal study would be needed to properly address the relationship of MC with surgical outcome.

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1. Introduction

In *Health 2000 Survey*, a Finnish national survey, every tenth Finn aged 30 or over had a chronic physician-diagnosed low back syndrome [1]. In a population-based European study, 19% of subjects had chronic pain and the low back was the source of pain among nearly half of these patients [2]. Chronic low back pain (LBP) causes enormous costs to society [3–5], both indirect and direct, and chronic pain increases mortality as well [6].

Quality of life (QoL) is defined by the World Health Organization as “individuals’ perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns” [7]. Health-related quality of life (HRQoL) takes into account an individual’s physical health, and mental and social domains of life [7,8]. Several questionnaires can be used to measure HRQoL, of which the SF-36 is used worldwide today because it produces scores on multiple aspects of HRQoL [8].

Modic changes (MC) are bone marrow and vertebral endplate lesions which are seen in magnetic resonance imaging (MRI) [9]. They can be divided into three different types: Type I represents an active ongoing inflammatory process; Type II is thought to reflect fatty degeneration of the bone marrow; while Type III is a late osteosclerotic regenerative process [10,11]. Several studies have shown that MC, especially type I, are associated with LBP [12–15].

The assessment of HRQoL among patients with LBP has been widely recommended [16]. The aim of this study was to examine the association of LBP related to MC with HRQoL among patients referred to lumbar spine surgery.

2. Materials and methods

2.1. Study population

Subjects consisted of consecutive patients referred to spine surgery at the Departments of Orthopedic Surgery and Neurosurgery at the Oulu and Kuopio University Hospitals between June 2007 and January 2011. The patients’ place of residence was mainly either the city of Oulu (population c. 140 000), the city of Kuopio (population c. 95 000) or the neighbouring municipalities of these cities, but the enrolment area comprised the three northernmost provinces of Finland: Oulu, Lapland, and Northern Savo. All participants took part voluntarily in the study and signed an informed consent form. The study was approved by the Ethics Committee of the Northern Ostrobothnia Hospital District and is in accordance with Declaration of Helsinki.

2.2. Assessment of pain, disability and health-related quality of life

Patients reported duration of LBP and leg pain. Back-related disability was assessed using the Finnish version of Oswestry Disability Questionnaire [17,18]. The diagnoses for surgical referral were obtained from hospital records. We measured HRQoL using the Finnish version of RAND-36 health survey, which is also known

as the SF-36 health survey [8,19,20]. RAND-36 and SF-36 health surveys are almost identical; they only differ in the wording of two health concepts, and the correlation of the two health concepts between the health surveys is 0.99 [19,21]. RAND-36 consists of eight health concepts: physical functioning, role limitations caused by physical health problems, pain, general health perceptions, role limitations caused by emotional problems, social functioning, emotional wellbeing and energy/fatigue. Each concept is rated on a 0–100 range. The higher the score, the better the HRQoL. The eight scales of RAND-36 were aggregated into two summary measures: the physical and the mental health components. The physical component consists of physical functioning, role limitations caused by physical health problems, pain and general health perceptions, while the mental component consists of role limitations caused by emotional problems, social functioning, emotional well-being and energy/fatigue [8]. The summary scores were calculated by multiplying standardized scores by 10 and adding 50 to the product. This yields a distribution of scores with a mean of 50 and standard deviation of 10 [21].

2.3. Magnetic resonance imaging and evaluation of imaging findings

Magnetic resonance imaging (MRI) of the lumbar spine was performed with 1.5-T equipment (Signa, General Electric, Milwaukee, WI and Magnetom Avanto, Siemens, Erlangen, Germany) on the patients referred to lumbar spine surgery. Routine spine MRI protocol was used, including sagittal T1- and T2-weighted images of the entire lumbar spine. The image matrix for T1-weighted images was 256 × 224 and 448 × 336 and for T2-weighted images 448 × 224 and 448 × 377 depending on the scanner used (in respective order). The field of view for the images was 28 cm × 28 cm and 30 cm × 30 cm. Slice thickness was 4 mm and 3 mm, and the interslice gap was 1 mm and 0.3 mm.

The scans were analysed in random order by three observers (J.K., J.N., J.M.) with no knowledge of the clinical status. The MC of both upper and lower endplates were classified on a workstation based on the five midsagittal planes, at each lumbar level, into Type I, Type II or Type III as earlier defined, and mixed Types I/II or II/III [10,11,13,22]. Types I and I/II were grouped together in the analyses (‘Type I’), as all lesions containing Type I change are thought to indicate a more active inflammatory process [15]. Similarly, Types II, II/III and III changes were grouped together (‘Type II’), as they were assumed to manifest a more chronic and stable degenerative process [9]. The height and width of each MC was evaluated and an index for the size of MC was calculated by multiplying the height and width of each MC. In case of MC at multiple levels, the size index of the largest lesion only was included. Signal intensity changes associated with Schmorl’s nodes or tiny spots of signal intensity change in the bone marrow adjacent to the vertebral corners were not recorded.

The degree of intervertebral disc degeneration (DD) was graded using the modified Pfirrmann classification [23]: normal height and clear distinction of the nucleus and annulus (grade 1 or grade 2), normal to slightly decreased height of the intervertebral disc and

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